

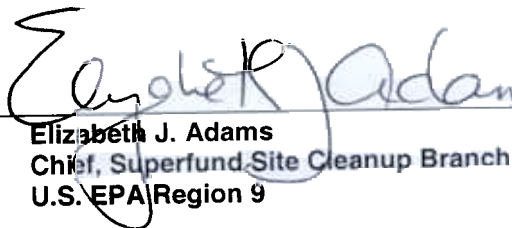
Third Five-Year Review Report

**Intel Corporation (Santa Clara III) Site
2880 Northwestern Parkway
Santa Clara, California**

**Prepared by
California Regional Water Quality Control Board
San Francisco Bay Region**

September 2006

Approved by:


Elizabeth J. Adams
Chief, Superfund Site Cleanup Branch
U.S. EPA Region 9

Date:

Sept 20, 2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX

75 Hawthorne Street
San Francisco, CA 94105

September 20, 2006

Stephen A. Hill
Chief, Toxics Cleanup Division
California Regional Water Quality Control Board, San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Re: Five-Year Review Report for Intel Corporation (Santa Clara III) Site, Santa Clara, CA

Dear Mr. Hill

The U.S. Environmental Protection Agency, Region 9 (EPA) has reviewed the third Five-Year Review Report for Intel Corporation (Santa Clara III) Site, prepared by the California Regional Water Quality Control Board, San Francisco Bay Region, dated September, 2006. This Five-Year Review is required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. (see OSWER No.9355. 7-03B-P, Comprehensive Five-Year Review Guidance, June 2001). The review addresses remedial actions taken pursuant to the September 1990 Record of Decision for the site.

EPA concurs that the groundwater remedy for Intel Corporation (Santa Clara III) Site currently protects human health and the environment, and upon the achievement of groundwater cleanup goals the remedy is expected to be protective in the long-term. The groundwater exposure pathway that could result in unacceptable risks is being controlled through the use of institutional controls prohibiting the drilling of groundwater wells.

The next Five-Year Review for the Fairchild San Jose site will be due in September, 2011. EPA appreciates the opportunity to work with you on this report. If you have any questions, please feel free to contact Penelope McDaniel of my staff at 415-972-3178.

Sincerely,


Elizabeth J. Adams, Chief
Site Clean-up Branch
Superfund Division

Table of Contents

List of Acronyms	3
Executive Summary	4
Five-Year Review Summary Form	5
I. Introduction	8
II. Site Chronology	9
III. Background	10
Physical Characteristics	10
Hydrogeology	10
Land and Resource Use	10
History of Contamination	11
Initial Response	11
Summary of Basis for Taking Action	11
IV. Remedial Actions	11
Remedy Selection	11
Remedy Implementation	12
System Operations/O&M	13
V. Progress Since Last Review	13
VI. Five-Year Review Process	14
Administrative Components	14
Community Involvement	15
Document Review	15
Data Review	15
Site Inspection	16
VII. Technical Assessment	16
Question A: Is the remedy functioning as intended by the decision documents?	16
Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid? ...	17
Changes in Toxicity Values.....	18
Question C: Has any other information come to light that could call into question the protectiveness of the remedy?	18
Technical Assessment Summary	19
VIII. Issues	19
IX. Recommendations and Follow-up Actions	20
X. Protectiveness Statement	20
XI. Next Review	20
Figures	21

List of Acronyms

BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
FFS	Focused Feasibility Study
GET	Groundwater Extraction and Treatment
HHRA	Human Health Risk Assessment
MNA	Monitored Natural Attenuation
MSCA	Multi-State Cooperative Agreement
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
ORD	Office of Research and Development
OU	Operating Unit
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RWQCB	California Regional Water Quality Control Board
SCR	Site Cleanup Requirements
TCE	Trichloroethene
TI	Technical Impracticability
ug/l	Micrograms per liter
VOC	Volatile Organic Compound

Executive Summary

The remedy for the Intel Corporation (Santa Clara III) Superfund site (Site) in Santa Clara, California included groundwater extraction and treatment (GET), groundwater monitoring, and institutional controls (see Figure 1). The Site achieved construction completion with the signing of the Preliminary Close Out Report on August 18, 1992. The trigger for this, the third Five-Year Review, is the second Five-Year Review, which was completed in August 2001.

The assessment of this Five-Year Review found that the remedy continues to be protective, but that groundwater cleanup standards cannot be met using GET. The GET system has remained shut down since the last Five-Year Review. The groundwater contaminant plume has been regularly monitored, and remains stable. Contaminant concentrations continue to slowly decline. Intel Corporation (Intel) has performed a Focused Feasibility Study (FFS), in an effort to identify cost effective alternative remediation technologies that may further reduce the remaining low contaminant concentrations in the groundwater. Based on the FFS, Intel plans to implement a treatability study to demonstrate the effectiveness of in-situ groundwater treatment using RegenOx, a controlled oxidizing technology.

Additionally, because the most recent soil gas samples were collected in 1988, another round of soil gas samples was collected. None of the 1988 samples detected soil vapors. As of the writing of this Five Year Review Report, the soil gas samples are being analyzed. Although soil gas concentrations are not expected to be elevated, these samples will serve to verify that concentrations have remained stable and pose no risk to human health. The next Five-Year Review for the Site will be conducted in 2011.

Currently, trichloroethene (TCE) is the only contaminant of concern that still exceeds the cleanup level of 5 micrograms/liter (ug/l). The highest level of TCE measured in the past 5 years was 29 ug/l, and is generally decreasing, with the most recent sampling results at or below 19 ug/l.

The remedy at the Site currently protects human health and the environment, and upon the achievement of groundwater cleanup goals the remedy is expected to be protective in the long-term. The GET remedy significantly reduced the contaminant concentrations in groundwater throughout the plume. The groundwater exposure pathway that could result in unacceptable risks is being controlled through the use of institutional controls prohibiting the drilling of groundwater wells.

Five-Year Review Summary Form, continued

Issues:

Although remaining groundwater concentrations are very low, the groundwater cleanup goals have not been met for the Site. However, Intel Corporation (Intel) has performed a Focused Feasibility Study (FFS) evaluation comparing the Record of Decision (ROD)-selected groundwater extraction and treatment (GET) remedy to other remedial alternatives, such as in-situ remediation technologies. The GET system has been very effective in reducing contaminant concentrations in the groundwater to very low levels. However, this system reached asymptotic levels and was no longer recovering significant quantities of contaminants. Therefore, active groundwater extraction ceased, and monitoring of groundwater plume ensued. Contaminant concentrations continue to slowly decline, indicating that natural attenuation processes are occurring. Because the GET remedy was ultimately changed to monitored natural attenuation, a ROD amendment will be necessary to document this modification and any other changes that affect the selected remedy.

The purpose of the FFS was to determine what other technologies can be implemented in order to achieve further, more cost-effective remediation of the remaining low-level groundwater contamination. Based on the conclusion of the FFS, Intel will perform a treatability study to determine the effectiveness of in-situ groundwater treatment by injecting RegenOx, an oxidizing compound, into the area of contaminated groundwater.

Because of the complex and heterogeneous nature of the subsurface geology, the remaining low levels of contamination in the groundwater may not be reduced to the cleanup goals, even with the additional in-situ remediation efforts. If, after sufficient time and effort, the contaminant levels do not reach the cleanup goals, then EPA will evaluate whether to waive cleanup goals for the areas of the Site on the basis that such attainment is not technically practicable. If a waiver is granted, Intel will need to continue groundwater monitoring on a regular basis until such levels are achieved.

In addition, based on available soil gas data, there is currently no exposure risk. However, additional soil gas samples have been collected and are being analyzed to determine if soil gas concentrations have remained stable, and pose no potential risk to human health.

In order to assess the risk from potential vapor intrusion should future residential redevelopment of the Site occur, a more comprehensive evaluation of the potential for vapor intrusion, using the most up-to-date TCE toxicity criteria, may be necessary.

Recommendations and Follow-up Actions:

An additional cleanup technology, in-situ RegenOx injection, was selected in the FFS, and a treatability study using this technology is being performed to determine the effectiveness of this in-situ groundwater treatment. The effectiveness of the cleanup technology will be monitored with reasonable frequency, and over a reasonable amount of time. The objective is to reduce the remaining low-level contaminant concentrations to the extent technically practicable.

However, groundwater cleanup goals may not be reached even with the additional RegenOx injection cleanup technology. The complex and heterogeneous nature of the subsurface geology may make it technically impracticable to remove all remaining low level contamination in the groundwater.

If the RegenOx technology is not effective in reducing the remaining contaminant concentrations to the cleanup levels, then EPA will consider whether to issue a Technical Impracticability waiver. In that case, the groundwater will continue to be monitored until cleanup goals are achieved.

Additional soil gas samples have been collected and are being analyzed to confirm that soil gas concentrations remain stable, and that there is no risk to human health.

If future residential redevelopment of the Site is planned, then a more comprehensive evaluation of the potential for vapor intrusion, using the most up-to-date TCE toxicity criteria, may be necessary. EPA will assess the need to modify the covenant accordingly.

Protectiveness Statement:

The remedy at the Site currently protects human health and the environment, and upon the achievement of groundwater cleanup goals the remedy is expected to be protective in the long-term. The GET remedy significantly reduced the contaminant concentrations in groundwater throughout the plume. The groundwater exposure pathway that could result in unacceptable risks is being controlled through the use of institutional controls prohibiting the drilling of groundwater wells.

**California Regional Water Quality Control Board
San Francisco Bay Region**

Five-Year Review

**Intel Corporation (Santa Clara III)
2880 Northwestern Parkway
Santa Clara, California**

I. Introduction

This report is the third Five-Year Review for the Intel Corporation (Santa Clara III) Superfund Site (Site), see Figure 1. The California Regional Water Quality Control Board (RWQCB or Regional Board), San Francisco Bay Region, conducted this review pursuant to the Multi-Site Cooperative Agreement (MSCA) between the U.S. EPA Region IX (EPA) and the RWQCB. The purpose of a Five-Year Review is to ensure that a remedial action remains protective of human health and the environment and is functioning as designed.

The first Five-Year Review was triggered by the signature date of the Preliminary Close Out Report. This Five-Year Review is required by policy because the remedial action requires more than five years to reach clean up goals. EPA Office of Emergency and Remedial Response, No. 9355.7-03B-P, "Comprehensive Five-Year Review Guidance" at Exhibit 1-1 (2001).

This Five-Year Review Report is prepared pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

EPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and

unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This Five-Year Review is required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. Specifically, contaminants in groundwater are present at levels exceeding the drinking water maximum contaminant levels. The triggering action for this review is EPA's signature date of the second Five Year Review in 2001.

II. Site Chronology

Site developed from agricultural land to a business park.	1975
Groundwater contamination discovered at the Intel Corporation (Santa Clara III) Site.	1982
Intel submits completed Regional Board facility questionnaire.	6/82
Groundwater extraction from two extraction wells begins.	2/85
Regional Board adopts NPDES Permit No. CA0028941 (Order No. 86-014) for the discharge of treated extracted groundwater at the Site.	3/19/1986
Intel Corporation (Santa Clara III) Site is added to the NPL.	6/1986
Initial Site Cleanup Requirements adopted.	1/89
Revised Site Cleanup Requirements adopted.	5/89
Regional Board adopts Order No. 90-105, the final Site Cleanup Requirements specifying the final RAP for the Site.	7/18/90
Record of Decision signed by EPA.	9/20/90
A third groundwater extraction well is added at the Site.	12/90
Regional Board adopts revised NPDES Permit No. CA0028941 for the discharge of treated extracted groundwater from the Site. Groundwater extraction and treatment from the expanded extraction system begins.	5/19/91
Pulsed pumping trials begin.	4/91
Regional Board allows the GET system to be shut down in response to a significant decline in contaminant removal rates. A trial of monitored natural attenuation is begun.	4/94
Regional Board issues coverage under Order No. 94-087, General NPDES Permit No. CAG912003, general permit for the discharge or reuse of extracted, treated groundwater resulting from the cleanup of groundwater from volatile organic compounds.	1/10/96
First Five-Year Review completed.	10/96
Second Five-Year Review completed.	8/01

III. Background

Physical Characteristics

The Site is approximately one acre in size and is located at 2880 Northwestern Parkway in the City of Santa Clara, California. The Site consists of a low-rise building and landscaping and parking areas. The City of Santa Clara has a population of 95,200, and is part of the San Francisco Bay Metropolitan Region which has a population of about six million. The Site is located in a light industrial and commercial area that is dominated by the electronics industry. It is in the area known as Silicon Valley, home to numerous computer-related companies. Most buildings in the area are low rise developments containing office space and research and development facilities. The nearest residential area is about 2,000 feet south and is upgradient of the Site with respect to groundwater flow direction.

Hydrogeology

Groundwater flows to the northeast towards San Francisco Bay. The Site is located in the Santa Clara Valley, a structural basin filled with marine and alluvial sediments. The coarser deposits are probably the result of deposition in or near stream channels that drain the highlands that surround the basin. Finer grain deposits result from a variety of conditions with the eventual result of a complex heterogeneous sequence of interbedded sands, silts, and clays. Municipal water supply wells tap an extensive deep regional confined aquifer that lies generally greater than 200 to 300 feet below ground surface (bgs). A thick, relatively impermeable aquitard separates this deep confined aquifer from a complex series of discontinuous aquifers and aquitards that can extend up to within a few feet of the ground surface. Two distinct water-bearing zones have been investigated at the Site. They are 1) the first encountered water-bearing zone, called the A-zone is found from 10 feet bgs to 25 feet bgs; 2) the next encountered water-bearing zone is called the B-zone and is found from about 30 to 45 feet bgs. The two zones are separated by a four to ten foot thick aquitard composed of clayey layer. There could be some hydraulic connection between the two zones due to the discontinuous nature of the sediment types. Contamination is confined to the A-zone. The groundwater contaminant plume is approximately 300 feet by 150 feet. The nearest municipal water supply well downgradient of the Site is the City of Santa Clara Well No. 33 located 1.6 miles north of the Site.

Land and Resource Use

The buildings at the Site were constructed in 1975 by Intel and have been in use since 1976 for performing quality control of chemicals and electrical testing of semiconductors. The Site and surrounding area were mainly agricultural until the 1960s and 1970s. The surrounding land uses are light industrial and commercial. There are no projected land use changes for the area around the Site.

History of Contamination

Groundwater contamination was first discovered at the Site in 1982 when groundwater samples were collected at the Site as part of a leak detection program for underground tanks initiated by the Regional Board in the South Bay Area. The source of contamination was never positively identified. Three potential sources were proposed, and to the extent practical, evaluated. The potential sources were: 1) leaks from the acid waste neutralization area; 2) spills near the above ground solvent storage facility; and 3) solvent spills associated with cleaning out pipes put in place during construction of the facility. Data collected during the evaluation of these sources indicates that it is unlikely that a source currently exists which could contribute to the existing VOC pollution in groundwater. The contaminants found in groundwater at the Site during the initial investigation included TCE, 1,1,1-TCA, 1,1-DCE, 1,1-DCA, 1,2-DCA, and Freon 113. Currently, only TCE is present above cleanup standards.

Initial Response

Following the discovery of groundwater contamination at the Site, the Regional Water Quality Control Board required Intel to perform a soil and groundwater investigation. Two groundwater extraction wells were installed and brought online to remove contaminated groundwater in 1985. A definite source for the contaminants was never found, and no significant soil contamination was ever found. As part of the investigations, an acid waste neutralization sump was removed. In 1990 Intel submitted a Remedial Investigation/Feasibility Study Report. The report evaluated the results of the subsurface investigations, the effectiveness of the interim groundwater cleanup actions, and evaluated remedial alternatives.

Summary of Basis for Taking Action

The Site overlies the Santa Clara Valley groundwater basin. Groundwater from this basin provides up to 50% of the municipal drinking water for over 1.4 million residents of the Santa Clara Valley. The Site was placed on the National Priorities List primarily because the past chemical releases posed a potential threat to this valuable resource.

IV. Remedial Actions

Remedy Selection

The Remedial Investigation/Feasibility Study Report (RI/FS) was submitted on February 16, 1990. This RI/FS was modified by a March 30, 1990 (revised June 19, 1990) staff report by the Regional Water Quality Control Board. The RI/FS, as amended, was the basis for the final Remedial Action Plan as set forth in Regional Water Quality Control Board Order No. 90-105, the Final Site Cleanup Requirements (SCRs), adopted on July 18, 1990. The Final SCRs contain the approved remedy for cleanup at the Site. The alternative that was selected in the SCRs as the final cleanup plan consisted of: 1) a land

use covenant prohibiting the use of shallow groundwater; 2) groundwater monitoring; 3) groundwater pumping from the A-zone; 4) treatment of extracted groundwater with activated carbon and discharge of the treated groundwater to the storm drain under an NPDES permit. The U.S. EPA signed the Record of Decision for the Site on September 20, 1990.

The SCRs set cleanup standards at California proposed or adopted Maximum Contaminant Levels (MCLs), EPA MCLs, California Action Levels, or levels based on a risk assessment. These cleanup levels are:

Chemical	Cleanup Standard (ug/l)
1,1-dichloroethane (1,1-DCA)	5
1,2-dichloroethane (1,2-DCA)	0.5
cis-1,2-dichloroethene (cis-1,2-DCE)	6
trans-1,2-dichloroethene (trans-1,2-DCE)	10
1,1-dichloroethene (1,1-DCE)	6
Freon 113	1,200
Freon 11	150
1,1,1-trichloroethane (1,1,1-TCA)	200
trichloroethene (TCE)	5

Remedy Implementation

The GET system and groundwater monitoring program were already implemented at the time SCRs were adopted. An additional extraction well was added in December 1990. At the time of the adoption of the SCRs, the efficiency of contaminant removal from groundwater by the GET system was declining. The contaminant levels in groundwater were approaching asymptotic levels, the point at which continued groundwater extraction will no longer reduce contaminant concentrations. The SCRs called for a pulsed pumping trial designed to see if the contaminant removal efficiency could be improved. A variety of pulsed pumping schemes were implemented beginning in April 1991; however, no significant increase in overall contaminant removal was obtained.

By 1994 the GET system had been operating for approximately nine years and was no longer removing significant levels of contaminants. The Regional Water Quality Control Board approved the cessation of groundwater extraction and allowed Intel to implement a monitored natural attenuation (MNA) program. MNA refers to a reliance on natural processes to reduce the concentration of pollutants at a site. In its guidance on this issue, EPA has defined MNA as follows:

MNA . . . refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The “natural attenuation processes” that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater.

EPA Office of Solid Waste and Emergency Response, Directive No. 9200.4-17P, “Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites” at 3 (1999) (MNA Guidance).

During the period of groundwater extraction approximately 45 million gallons of groundwater was extracted and treated, and approximately 28 pounds of TCE, the primary contaminant, had been removed. The majority of contaminant mass was removed in the first few years of operation of the GET system.

The Regional Board and Intel entered into a land use covenant that prevents the drilling of groundwater production wells. The covenant has been finalized and recorded.

Systems Operation/Operation and Maintenance

The GET system was shut down in 1994. The system has not been operated since then. Pursuant to a semi-annual groundwater monitoring program, groundwater elevations and flow direction are determined and monitoring wells are sampled for VOCs. Intel submits annual reports to the Regional Water Quality Control Board.

For all activities related to groundwater cleanup at the Site, Intel incurred costs of \$255,900 during the period of January 2001 through December 2005. The projected costs were \$91,200. The difference is due to higher than anticipated costs for monitoring/reporting, regulatory oversight, and unanticipated costs for activities related to pursuing delisting of the Site and for decommissioning of several wells in 2003. The following table provides details of the costs.

**Remedial Action Costs
Intel Corporation (Santa Clara III) Site
July 2001 – December 2005**

Cost Component	Cost July 2001 to December 2005
Monitoring/Reporting	90,900
NPDES Permit Renewal/Maintenance	12,000
Regulatory Evaluations/Negotiations	30,000
Regulatory Oversight	60,000
Project Related (closure related)	63,000
Total Costs	255,900

V. Progress Since Last Review

No issues of concern were identified in the previous Five-Year Review, and the remedy was found to be protective of human health and the environment.

When the GET system was shut down, the system was no longer removing significant amounts of VOCs. The Regional Board also recognized that there were limits to existing treatment technologies, and that achievement of drinking water standards may not be feasible in the short term through active remediation. The Regional Board allowed Intel to monitor natural attenuation to determine what effect this would have on the pollutant plume. The pollutant plume has stayed stable, and, since shutdown of the treatment system, VOC levels have been slowly decreasing. TCE is the only contaminant above the cleanup level. The highest concentration of TCE recorded in the past five years is 29 ug/l; the most recent sampling results are at or below 19 ug/l. This level is down from 45 ug/l at the time of the last Five-Year Review. The potential risk to human health and the environment is very low at the Site. The cleanup level for TCE is 5 ug/l, the federal drinking water MCL. This level is based on an excess cancer risk of one in one million for an exposure scenario of contaminated groundwater being used for domestic supply for a period of 30 years.

No interviews were conducted during this Five-Year Review other than routine follow-up questions of the consultant performing the cleanup regarding activities at the Site. Contamination at the Site is confined to groundwater.

VI. Five-Year Review Process

Administrative Components

The California Regional Water Quality Control Board has been the Lead Agency for the Site. Recently, EPA assumed the role of Lead Agency in August 2006.

Community Involvement

A public notice was placed in the *Silicon Valley Community Newspaper* on August 16, 2006, announcing that the Five-Year Review was being conducted, and inviting interested members of the public to contact EPA with any questions, concerns, or information to share about the remedy being conducted at the Site. A draft Five Year Review Report was placed in the Santa Clara Library – Central Park Branch. No comments were received.

Document Review

This Five-Year Review consisted of a review of relevant documents including:

Intel Corporation (Santa Clara III) Site Five-Year Status Report, January 2006
Annual groundwater monitoring and progress reports (2000 – 2005)
Final Site Cleanup Requirements Order No. 90-105, July 18, 1990
EPA Record of Decision for the Intel Corporation (Santa Clara III) Site
Focused Feasibility Study – Intel Corporation (Santa Clara III) Site, February 2006

Data Review

Groundwater monitoring data collected from 2000 to 2005 were reviewed to evaluate the groundwater pollutant plume and to determine if and how the plume has responded to the non-pumping conditions that have been in place since 1994. The GET system that came online in 1985 and expanded with an additional extraction well in 1990 was successful in removing VOC mass and reducing concentrations of VOCs in groundwater. After several years of groundwater extraction, however, the amount of VOC mass being removed had declined considerably, and VOC concentrations in groundwater seemed to be stabilizing. This phenomenon of an initial significant reduction in VOC concentrations followed by a leveling off of the reduction in VOC concentrations has been found to occur at many other sites in the area and around the country. In 1994 the Regional Board approved Intel's request to leave the GET system shut down, which would allow an assessment of whether the pollutant plume would remain stable without pumping and if monitored natural attenuation could be an effective method of remediation. The GET system has remained shut down since then, and the Site has been monitored to ensure the plume is not migrating and to determine the effectiveness of natural attenuation.

To evaluate the effectiveness of monitored natural attenuation at the Site, four indicators were evaluated, as recommended by EPA's MNA Guidance. The four indicators are:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions that may reduce the efficacy of the natural attenuation processes;
- Identify any potentially toxic or mobile transformation products; and

- Verify that the plume is not expanding either downgradient, laterally, or vertically.

A review of the monitoring well data shows that, in general, the groundwater pollutant plume has remained stable since groundwater extraction ceased. The wells at the downgradient end of the plume have remained at non-detect or at less than the 5 ug/l cleanup standard for TCE. There have been no increases in chemical concentrations in these wells and thus, the pollutant plume has not expanded downgradient.

TCE concentrations in the interior of the plume have been slowly decreasing. Significant reduction in contaminant concentrations, which occurred in the first few years of groundwater extraction, helped stabilize the plume. It was expected that the plume concentrations would slowly decrease through the processes of natural attenuation. This has proven to be the case, and contaminant concentrations have been slowly but steadily decreasing.

No potentially toxic or mobile transformation products have been identified during sampling.

The plume has not expanded in area since the last Five-Year Review. Contamination remains confined to the shallowest aquifer and has not migrated vertically.

Site Inspection

A site inspection was conducted on August 2, 2006 by Regional Board and EPA staff. No activities that could interfere with cleanup of the Site were observed. The institutional controls that are in place include a land use covenant prohibiting the drilling of groundwater production wells until cleanup levels are achieved. No activities were observed that would have violated the institutional controls. The Site consists of single story office buildings, parking lots, and landscaping. VOC contamination in groundwater is confined to the A-zone.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

As discussed above, the GET system at the Site was shut down in 1994. The Regional Board approved the shut down because the system had reached asymptotic levels, and the efficiency of VOC removal through groundwater extraction had declined considerably, even after pulsing the system. Having shut down the GET system, Intel instituted a groundwater monitoring program to determine if natural attenuation could successfully contain and remediate the contaminated groundwater plume.

The current groundwater monitoring program is sufficient to track the plume and detect any migration beyond the current plume boundaries, as well as track the effectiveness of monitored natural attenuation in remediating the VOC plume. As reflected in the

monitoring data, the plume has not expanded in size since the GET system was shut off. Downgradient monitoring wells have remained at non-detect or below the cleanup level. The plume has not migrated vertically and contamination remains confined to the shallow most groundwater bearing zone (A zone). VOC concentrations have slowly been declining since the GET system was shut down.

There were no opportunities for system optimization observed during this review. Cyclic pumping has been tried at the Site. It was not effective in increasing the efficiency of VOC removal. The existing monitoring well network provides sufficient data to assess the progress of natural attenuation.

However, Intel has performed a Focused Feasibility Study (FFS), an evaluation comparing the ROD-selected GET remedy to other remedial alternatives, such as in-situ remediation technologies. The purpose of the FFS was to determine what other technologies can be implemented in order to achieve further, more cost-effective remediation of the remaining low-level groundwater contamination. Based on the conclusion of the FFS, Intel is in the process of performing a treatability study to determine whether in-situ treatment of groundwater at the Site might be effective. Specifically, Intel is injecting RegenOx into the groundwater, which consists of a controlled subsurface oxidizing reaction that reduces contaminant compounds. Deployment of this technology is a potential way to achieve cleanup standards at the Site.

If the RegenOx technology is not effective in reducing the remaining contaminant concentrations to the cleanup levels, Intel plans to seek a Technical Impracticability waiver from EPA. In any event, the ROD for the Site will need to be amended to reflect the implementation of the monitored natural attenuation remedy, and any other changes to the selected remedy. The ROD Amendment will also assess the technical practicability of reaching the groundwater cleanup requirements, and will reflect any determination made with respect to the potential need for vapor mitigation engineering controls for future residential redevelopment of the Site.

The institutional controls in place include a land use covenant prohibiting the drilling of groundwater production wells until cleanup levels are achieved. No activities were observed that would have violated the institutional controls. EPA does have some concerns about the continuing validity of the covenant in light of recent regulatory revisions, however, and is currently evaluating the need for a new covenant.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

There have been no changes to the physical conditions of the Site that would affect the protectiveness of the remedy. The only land uses on-site remain commercial and office space.

There have been no changes to Applicable, Relevant, and Appropriate Requirements for the Site and no new standards that would affect the protectiveness of the remedy. Note,

however, that a recently implemented regulation – California Code of Regulations, Title 22, Section 67391.1 – sets forth new procedures for environmental land use covenants. EPA is evaluating whether a revised covenant that complies with these requirements will be necessary to maintain the protectiveness of the institutional controls. Currently, only TCE exceeds the groundwater cleanup standards.

The exposure assumptions used to develop the Human Health Risk Assessment (HHRA) were for potential future exposure if untreated groundwater were to be used for drinking water and if residential uses were to occur on the Site. In the future, if the Site is to be redeveloped for residential use, a comprehensive risk assessment may need to be conducted in order to assess any potential vapor intrusion pathways, using the most up-to-date TCE toxicity criteria. Since preparation of the HHRA, there have been no changes to the toxicity factors for the contaminants of concern. However, as discussed in the “Changes in Toxicity” section, below, there is continuing discussion regarding TCE toxicity. These factors are considered to be conservative in evaluating risk and developing risk-based cleanup levels.

No one is currently using the groundwater beneath the Site. A land use covenant prohibits the drilling of groundwater production wells. The land use of the Site is commercial/industrial. No change to the assumptions, or to the cleanup levels based on them, is warranted. There have been no revisions to the standardized risk assessment methodology that could affect the protectiveness of the remedy. The Regional Board has developed risk-based screening levels for a variety of exposure routes, including vapor intrusion into buildings from underlying groundwater contamination. The current levels of TCE in groundwater at the Site are below the Regional Board’s screening levels for potential indoor air risk for both a commercial/industrial and residential use scenario.

Changes in Toxicity Values

Since the 1990 HHRA, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. Revisions to the toxicity values for 1,1-DCE and vinyl chloride indicate a lower risk from exposure to these chemicals than previously considered. On the other hand, evaluation of the toxicity values for PCE and TCE is ongoing and may indicate higher risks from exposure than previously considered.

The greatest uncertainty with toxicological changes for the Site is associated with TCE. In August 2001, EPA’s Office of Research and Development (ORD) released the draft “Trichloroethylene Health Risk Assessment: Synthesis and Characterization” (“TCE Health Risk Assessment”) for external peer review. The draft TCE Health Risk Assessment takes into account recent scientific studies of the health risks posed by TCE. According to the draft TCE Health Risk Assessment, for those who have increased susceptibility and/or higher background exposures, TCE could pose a higher risk through inhalation than previously considered. The draft TCE Health Risk Assessment is available on-line at: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=23249>.

The Science Advisory Board, a team of outside experts convened by EPA, reviewed the draft TCE Health Risk Assessment in 2002. The Science Advisory Board’s review of the

draft TCE Health Risk Assessment is available at:
<http://www.epa.gov/sab/pdf/ehc03002.pdf> .

In July 2006, the National Academy of Sciences completed additional peer review of scientific issues that were the basis for the draft TCE Health Risk Assessment. In response to this review, EPA will revise the draft TCE Health Risk Assessment. Consequently, review of the toxicity value for TCE may continue for a number of years. This issue will need to be updated in subsequent Five-Year Reviews.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has been identified that could effect the protectiveness of the remedy. However, as discussed above soil vapor samples have been collected and are currently being analyzed to confirm that the soil gas concentrations have remained stable and pose no risk to human health.

Technical Assessment Summary

According to the data reviewed and the site inspection, the remedy selected in the ROD operated as intended for nearly 10 years. At that point the system had reached asymptotic levels and was no longer recovering significant quantities of contaminants. Therefore, active groundwater extraction ceased, and monitoring of the groundwater plume ensued. Concentrations continue to slowly decline.

There have been no changes in the physical condition or land use of the Site that would affect the protectiveness of the remedy. Most of the cleanup standards have been met, however TCE still exceeds groundwater cleanup standards. There have been no changes in the toxicity factors used in the HHRA, and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. However, as discussed in the “Changes in Toxicity” section, above, there is a continuing discussion about TCE toxicity. There is no other information that calls into question the protectiveness of the remedy, other than potential risks associated with vapor intrusion pathway, as evaluated using EPA’s TCE toxicity criteria.

VIII. Issues

The ROD for the Site will need to be amended to reflect the implementation of a new remedy (monitored natural attenuation) and to assess the technical practicality of reaching the groundwater cleanup requirements. The Amended ROD should also reflect the possible need for vapor mitigation engineering controls for future residential redevelopment of the Site, should an evaluation using the most up-to-date TCE toxicity criteria suggest there is cause for concern. Intel intends to perform in-situ groundwater remediation using injection of RegenOx in an attempt to reach groundwater cleanup goals.

IX. Recommendations and Follow-up Actions

Site Cleanup Requirements Order 90-105 and the ROD specify the final remedial action plan for the Site to be a GET system. Because groundwater extraction is no longer being used at the Site, the ROD will need to be amended to reflect the change in cleanup method, and any other changes that significantly affect the selected remedy.

The effectiveness of reducing contaminant concentrations in the groundwater with in-situ RegenOx injection technology will be evaluated with an approved monitoring schedule.

As discussed above, additional soil gas samples have been collected and are currently being analyzed to verify that the soil gas concentrations are stable and to ensure there is no risk to human health. In addition, if the land use changes from the current commercial/industrial use to residential use, a comprehensive indoor air evaluation for residential use may need to be completed to ensure long-term protectiveness. At that time, based on the outcome of these assessments, the ROD should be amended, as necessary, to reflect any necessary vapor intrusion mitigation controls. If it is necessary, the land use covenant will be revised to reflect land use restrictions. Barring any unforeseen delays, a ROD Amendment should be completed by 2008.

Groundwater VOC levels have been reduced such that the current levels of TCE (the only contaminant of concern that exceeds cleanup standards) in groundwater at the Site are below the Regional Water Quality Control Board's screening levels for potential indoor air risk for both a commercial/industrial and residential use scenario. However, the new soil gas samples that have been collected and are currently being analyzed will ensure that the soil gas concentrations are stable, and that there is no risk to human health.

The existing monitoring well network and sampling program is sufficient to track the stability of the plume and the progress of natural attenuation in remediating the groundwater contamination.

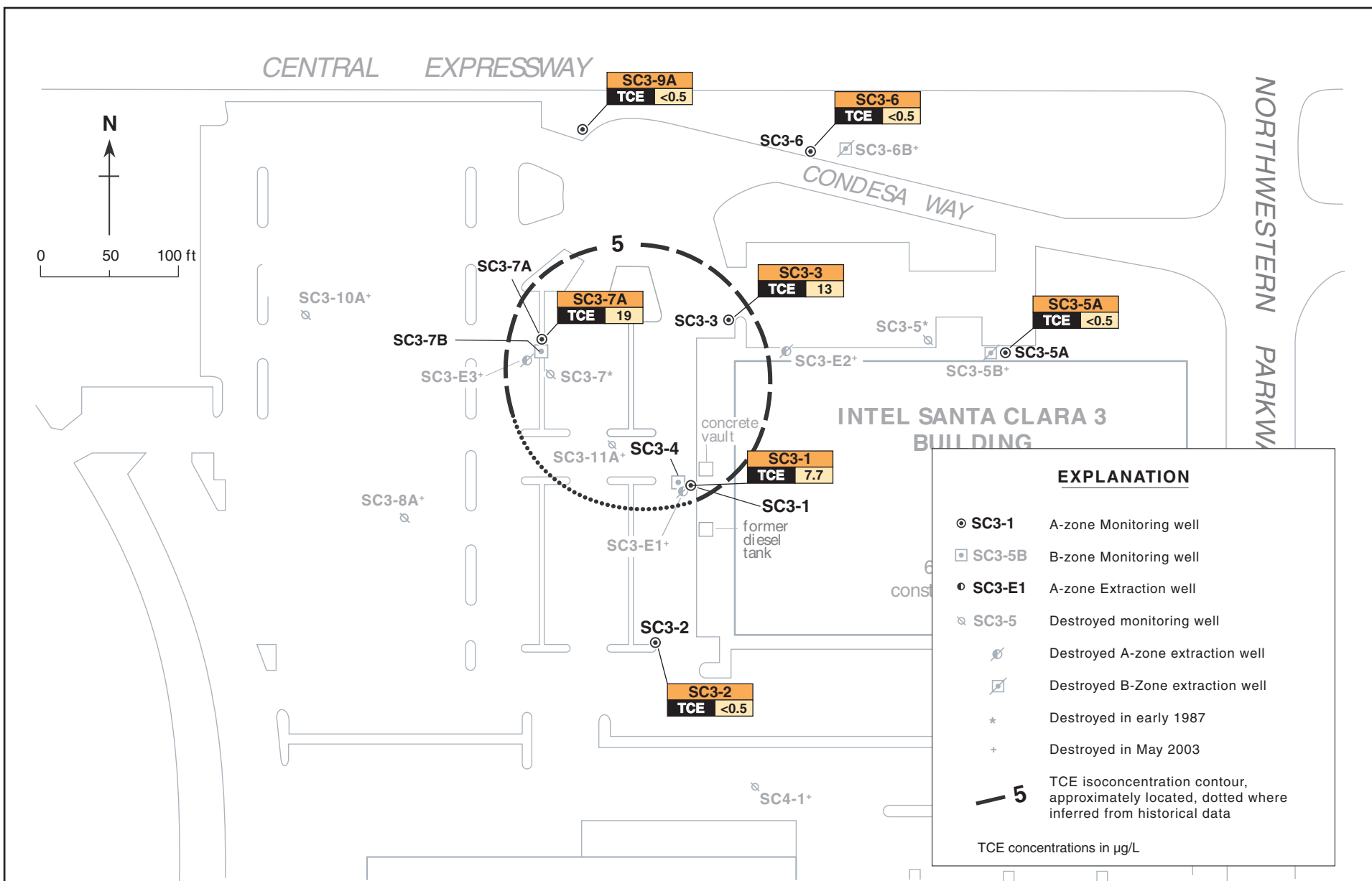
X. Protectiveness Statement

The remedy at the Site currently protects human health and the environment, and upon the achievement of groundwater cleanup goals the remedy is expected to be protective in the long-term. The GET remedy significantly reduced the contaminant concentrations in groundwater throughout the plume. The groundwater exposure pathway that could result in unacceptable risks is currently being controlled through the use of a land use covenant that prohibits the drilling of groundwater wells.

XI. Next Review

The next Five-Year Review for the Site is required by September 2011.

FIGURES



Source materials: Weiss Associates

DISTRIBUTION OF TCE IN THE A WATER-BEARING ZONE
— APRIL 20, 2006
Intel Santa Clara 3, Santa Clara, CA

Figure 1

by: MJC

MAY 2006